

Diagnosis of the State of the Territory in Flanders. Reporting About New Maps and Indicators Differentiating Between Urban and Rural Areas Within Flanders



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Abstract Within the several European analyses of spatial patterns, Belgium and Flanders take a specific position. The average ‘settlement area percentage’ (i.e., all land used beyond agriculture, semi-natural areas, forestry, and water bodies) for Europe is 4%, but 32% of the Flemish area is occupied with artificial land. Belgium has the highest score for urban-sprawl indicators, and within the European context, almost the entire area is considered urban. The aim of the research presented in this paper is to expand on the theme of indicators for spatial patterns by analyzing the Flemish area with detailed data across various scales. The results are collected in a report, the ‘*Ruimterapport*’— ‘RURA’, published in 2018. RURA is a bundling and compilation of research results from very diverse sources, amongst others studies from the Department of Environment and Spatial Development of Flanders and of Espon studies. This article presents the most important results from RURA and further positions them in international comparative literature. New maps and indicators are developed for the urban/peri-urban/rural dimensions of the human settlement area, urban sprawl, and settlement patterns by differentiating amongst others between urban centers, ribbon development, and scattered buildings. The paper gives a quantitative, methodological, and empirical contribution to the field of urban and regional development processes and contributes to conceptualizations of space. The case of Flanders, with its specific sprawl pattern, illustrates the difficulties spatial planning policy makers currently are facing, dealing with the complexity of space and society.

Keywords Urban/peri-urban/rural dimensions · Indicators · Land use · State report

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1 Introduction

In international analyses of spatial patterns, Belgium and Flanders often stand out. A few examples to illustrate this follow. The average ‘percentage of land take’ in 2013–2015 [= all land used by man and thus not for agriculture, semi-natural areas, forestry or water-covered (European Commission 2012)] for Europe is 4% (Eurostat E4.LUCAS (ESTAT) 2015), but amounts to 32% for Flanders (Poelmans et al. 2016b). In various analyses, almost the entire Belgian and Flemish territory is considered urban (Copus and Hörnström 2011; ESPON 2013 Programme Coordination Unit 2013), despite the fact that there is also a lot of rural area in Europe and in Belgium. Moreover, because Flanders and Belgium have a limited surface area, much of the diversity within the territory is lost.

Because of the specific (average) characteristics of Flanders and Belgium and also to gain even more insight into the differences within their own territory, RURA, ‘Ruimterapport Vlaanderen’, was developed in 2018 (Pisman et al. 2018). The report contains many spatial analyses: descriptions of the occurrence of certain activities in the field; how spatial patterns have changed over time; and what evolution can be expected. This article presents the most important results from RURA and further positions them within the international comparative literature.

RURA is inspired by indicators from the ‘Compendium for the Environment’ (the Netherlands) (<https://www.clo.nl>), by indicators collected by the European Environment Agency (<https://www.eea.europa.eu/soer>), by the ‘*Diagnostic Territorial de la Wallonie*’ (CPDT Conférence Permanente du Développement Territorial Wallonie 2011), by a comparative report in France (Cget 2015), etc.

The common thread running through the report is the far-reaching fragmentation of space. Flanders is characterized by high land take, a significant rate of development, many urban and rural centers and building concentrations, large dwellings with limited building height and relatively large-scaled gardens, facilities, and businesses scattered throughout the territory, small agricultural plots, many trees but relatively few forests, lots of solar panels scattered on the roofs of many private structures, etc. This fragmentation creates many challenges for the future, such as providing sufficient drinking water, switching to renewable energy sources, reducing car mileage and promoting sustainable travel, optimizing the energy efficiency of existing buildings, etc.

2 Methodology

RURA is a bundling and compilation of research results from very diverse sources. Every year, the Department of Environment and Spatial Development launches a research agenda resulting in dozens of research reports. The studies are both qualitative and quantitative and cover various topics, ranging from policy explorations to in-depth studies in which, for example, model-based analyses are carried out. Many

of these research reports have provided insights for RURA. On the other hand, we did make grateful use of many Espon studies (<https://www.espon.eu>), which made benchmark analyses between the various European countries that enabled comparing the results of Flanders with European averages or extremes.

The land-use map of Flanders, a grid map with 10-m resolution indicating the dominant land use for each pixel, has multiple uses. The land use refers to the effective use of land for specific activities or crops, such as farming, grass cultivation, but also housing, industry and services, recreation, etc. Of course, the land use of a location is not necessarily identical to its zoning in a legally binding zoning plan. Land can be zoned as a residential area, but effectively used as grassland or arable land. In the industrial sectors, for example, land use also includes water. In RURA, the data from the land-use database of 2013 have been used. The land-use file is drawn up on the basis of mainly vector operations, but, in the final steps, it is converted to a grid file at 10-m resolution (Poelmans et al. 2016a). European datasets on land use, such as CORINE and LUCAS, and on other themes are of course also available, but very often, due to limited geographical accuracy, they do not allow a more detailed spatial analysis to be carried out within Flanders.

The research methods used in RURA are very diverse. Broadly speaking, this can be regarded as mixed-methods research in which qualitative and quantitative research methods are combined. The exploratory method dominates. A phenomenon (such as sprawl, urbanization, underuse of houses, etc.) is investigated by means of a literature study from various sources. If data were available, this phenomenon was further explored by means of quantitative analyses and mapped, incorporating statistical and GIS methods.

The maps can be displayed at various resolutions, depending on the scale of the phenomenon and/or the geographical accuracy of the data. The RURA contains maps with indication of point locations (individual addresses), indication of spatial differences on-grid scales, on the scale of cadastral parcels, statistical sectors, and municipalities. The urbanized—urban—rural typology has as its resolution the statistical sector. This accuracy makes it possible to distinguish more or less urbanized neighborhoods (within a municipality). The center-ribbon-dispersed typology is based on differences between cadastral parcels. This approach, therefore, labels each parcel and makes clear for each parcel whether it belongs to a larger whole of parcels with similar characteristics or not. Finally, the sprawl typology uses a grid analysis with a resolution of 1 ha. These grids are sometimes larger and sometimes smaller than the cadastral parcels in the center-ribbon-dispersed typology. This alternative approach makes it possible to discover spatial differentiation within large, only partly built-up plots.

3 Diverse Spatial Typologies for Flanders

The purpose of RURA is to describe the spatial appearance and functioning of Flanders, not only on the basis of global characteristics but also on the basis of spatial differences within Flanders. Many reports describe divergences in Flanders between municipalities or provinces: examples are the municipal and urban monitor (<https://gemeente-en-stadsmonitor.vlaanderen.be>), analyses by VRIND (Vlaamse Overheid 2015) or the Belfius typology (<https://research.belfius.be/nl/typologie-gemeenten>). These administrative boundaries are not always spatially relevant. Within an urban municipality, for example, there is often both a city center and a peri-urban or rural periphery. Municipal indicators and analyses make abstractions of these various spatial environments.

For this reason, new spatial typologies were developed within RURA that make it possible to identify and describe spatial differences. The scale on which these typologies have been developed is obviously very decisive for the result. In this article, we will take a closer look at three spatial typologies, each of which has been identified on a specific, different scale.

3.1 *Urban—Peri-Urban—Rural Flanders*

Recent worldwide morphological development has generated new territories that are characterized by different degrees of urbanity. The traditional methods of classification based on the distinction between urban and non-urban areas are no longer functional to describe the territorial outcomes of these transformations. In recent times, scholars started questioning the urban/rural dichotomy, proposing a multi-scalar approach. Cattivelli (2019) distinguished, within Europe, more than 80 methods to describe the gradient between urban and rural areas.

In RURA, a rural–urban typology was developed specifically for Flanders (see Fig. 1). The intention is to frame the thematic analyses on housing, open space, etc. within a spatial context, making a distinction between ‘urbanized Flanders’, ‘peri-urban Flanders’, and ‘rural Flanders’. Data on land take (morphology/human settlement area), population density, and employment density were combined. The threshold values were determined on the basis of European key figures and refined together with experts after an analysis of different map images and corresponding values.

The urbanized part of Flanders is characterized by:

- high land take ($\geq 32.5\%$, i.e., more than the average for Flanders)
- high activity rate: high population density and/or high employment density (population density ≥ 11.85 inhabitants/ha or more than average plus half the standard deviation, employment density ≥ 10.14 employees/ha or more than average plus half the standard deviation)
- contiguous, urbanized clusters with at least 15,000 inhabitants.

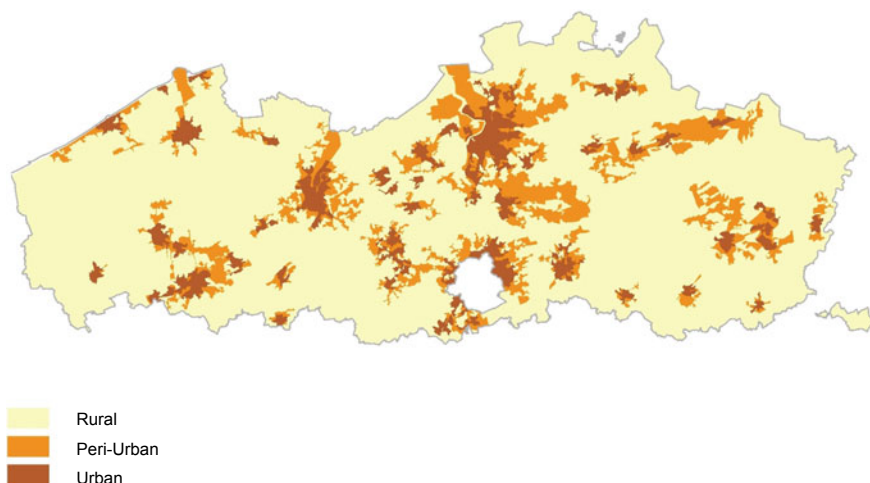


Fig. 1 Urban—peri-urban—rural Flanders (Pisman et al. 2018, Fig. 1.18: 34)

The peri-urban part of Flanders includes the area is defined by:

- high land take ($\geq 32.5\%$, i.e., more than the average for Flanders)
- low activity rate, below the limits that apply to high activity rate.
- contiguous clusters adjacent to the urbanized area.

The rural part of Flanders has at least one of the following features:

- low land take, i.e., $< 32.5\%$
- high land take and a high degree of activity but not belonging to an urbanized cluster with at least 15,000 inhabitants
- high occupancy and less activity and not adjacent to an urbanized area.

The urbanized part of Flanders includes the statistical sectors which together form the city center of a large, regional, or small urban area, but also the industrial areas with a high employment density on the periphery of these city centers. The peripheral urban part of Flanders comprises sectors that are mainly characterized by human activities, but which nevertheless have a rather lower density of activity. Typical examples are the residential districts and built-up villages on the edges of the city centers. The rural part of Flanders contains sectors with scattered buildings, but also many village centers, or urban centers that do not meet the threshold of 15,000 inhabitants. The central part of Flanders is a patchwork of urbanized, peripheral, and rural areas. The periphery of Flanders has a more rural character. In Table 1, the key figures of the urban/peri-urban and rural part of Flanders are displayed.

Table 1 Key figures of the urban/peri-urban/rural typology

	Urbanized (%)	Peri-urbanized (%)	Rural (%)
Covered area	7	13	80
Inhabitants	41	20	39
Households	44	20	37
% Built-up	20	8	2
% Sealed	50	26	9
% Land take	85	61	23
% Agriculture/forestry	10	33	75

3.2 Centers, Ribbon Development and Scattered Buildings

The settlement pattern of Flanders is dominated by many scattered buildings and by ribbon development. The ribbons in Flanders were mapped in an analogue way for the first time in 1993 (Larnoe 1993; Janssens et al. 1993). At that time, the Flemish landscape was already to a large extent characterized by ribbon development, with the exception of the coastal polders and the southern part of the province of Limburg. On the maps, both ribbons radiating from human settlement areas, as well as more isolated ribbons that form the basic structure of the built-up environment, were distinguished. More recently, the Flanders Environment Agency (Gulinck et al. 2007) and the Resource Center for Spatial Development and Housing (*‘Steunpunt Ruimte en Wonen’*) (Tempels et al. 2011), among others, attempted to portray the settlement pattern of Flanders.

The Flanders Environment Agency detected sprawl based on maps and satellite images from different periods. Within the framework of the Resource Center, a GIS methodology was developed to distinguish between residential areas (as defined by the NIS), ribbons, and scattered buildings. De Meulder et al. (1999) point to the historical reasons for the typically Belgian form of urban expansion, encouraged and facilitated by the construction of the extensive railway network and the early introduction of cheap train tickets. De Decker (2011) stated that Belgian urban sprawl and dispersed buildings are related to an institutionalized anti-urban attitude on the part of both citizens and the government, whereby access to urban facilities is decoupled from living in the city, at least in a psychological sense. Furthermore, this is also related to the long tradition of home ownership, which has led to social norms and expectations that are strongly determined by individual ownership and to housing aspirations which are easier to realize outside the city than in the city. The regional zoning plan, in which many residential areas to be developed have been zoned all over the Flemish territory, has also played a very decisive role in the further development of housing in Flanders (Verbeek et al. 2014).

In RURA a typology has been developed in which Flanders is divided into cores or centers, ribbons and scattered buildings (see Fig. 2). This methodology is inspired by the analyses carried out within the framework of the Resource Center. For the

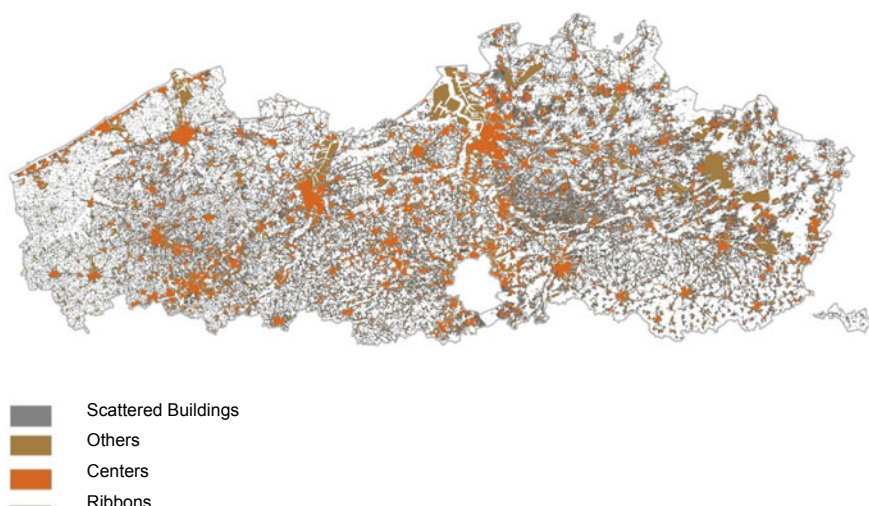


Fig. 2 Centers/ribbon development/scattered buildings in Flanders (Pisman et al., Fig. 1.26: 40)

morphological analysis, the geographical layer with the (main) buildings of the Large Scale Reference Database Flanders (state 2013) is employed. This includes housing units and apartments, but also sports halls, shops, storage space, etc. The typology is not related to legal zoning or future policy, and the analysis is not area-covering for Flanders. Military domains and the legally designated business parks of more than 3 ha, which are not completely enclosed by center-areas, are not included in the typology (about 6% of the surface area of Flanders, indicated as 'others' on Fig. 2). The threshold values for distinguishing the various categories were determined in consultation with experts after an analysis of various map images and corresponding limit levels. The typology has been elaborated to the scale of the individual cadastral parcel.

The centers are characterized by:

- High building density (>30 buildings within a 100-m radius)
- Substantive built-up area (>9500 m² within 100-m radius) or high density of households (>60 households within a 100-m radius)
- minimum total surface >5 ha
- minimum number of households >20.

The ribbons have the following characteristics:

- length >200 m
- built-up on one side of the road or on both sides of the road
- buildings situated relatively close to the road (<25 m) and close to each other (in-between distance <50 m). (This creates the impression of a built-up street wall and the view to the open area behind is limited.)

Table 2 Key figures of the centers/ribbons/scattered typology

	Centers	Ribbons	Scattered buildings
# Centers	1.485		
Length		13.000 km	
# Buildings			525.000
Inhabitants (%)	70	25	5
% Built-up	42	26	16
% Sealed	61	40	32
% Land take	95	100	100

Finally, the scattered buildings include all the main buildings that are not part of the centers or ribbons of Flanders. In practice, they are scattered in open space, or in small concentrations that do not meet the characteristics of a core or center, or they are built at a greater distance from each other and are therefore not perceived as ribbons. Table 2 shows the key figures of the centers/ribbons/scattered typology.

3.3 *Urban Sprawl*

In recent years, various international comparative reports on urban sprawl have been published (Bruegmann 2005; European Environment Agency 2006, 2016; OECD 2018). Although each report or analysis uses its own methodology and data, one constant remains: the sprawl in Flanders and Belgium, in general, is high. The 2016 EEA report defines urban sprawl as the pattern in which larger areas are affected by single buildings or more extensive forms of low-density urban sprawl. The definition focuses on three issues: (1) urban sprawl refers to built-up areas, (2) which are scattered, and (3) in which the take-up of space by activities (number of inhabitants or employment) is high.

The three elements form ‘sub-indicators’ (PBA, DIS, and LUP) of which a product (= WUP) is finally made to yield one composite and integrated indicator of urban sprawl:

- WUP—weighted urban proliferation: weighted product of DIS, PBA, and LUP
- PBA—percentage of built-up areas
- DIS—dispersion of built-up areas: quantification of the dispersed nature of the built-up areas
- LUP—land used per inhabitant or workplace.

For years research has been conducted into the existence of urban sprawl in Flanders (De Decker 2011; De Geyter 2002; Poelmans and Van Rompaey 2009; Stec Group et al. 2018; Verbeek et al. 2014; Vermeiren et al. 2018, 2019).

Starting from the European approach (European Environment Agency 2016), but using more accurate data, WUP maps (resolution 1 ha) for Flanders were drawn

up within the framework of RURA. In comparison with the European data, we can assume that a WUP value higher than 10 should be considered as urban sprawl. Approximately 44% of the Flemish land surface falls into this category and no less than 95% of the Flemish population lives in urban-sprawl areas. Only the centers of the largest cities and the larger open spaces and natural areas fall outside this category.

The WUP indicator is not so easy to interpret. An equivalent WUP value does not always refer to similar spatial patterns. Both areas with a lot of open space and locations with highly concentrated buildings have a low WUP value, and therefore have little or no urban sprawl. Very low and very high WUP values can be found correlated with different building, population, and employment densities. The WUP map was therefore crossed with data on activity levels (density of inhabitants and employment) to arrive at a more intuitive urban-sprawl typology consisting of four important categories: ‘scattered buildings’, ‘allotments and ribbons’, ‘villages and peri-urban areas’ and ‘city centers’ (Pisman et al. 2019) (see Fig. 3).

Table 3 displays the key figures of the sprawl typology.

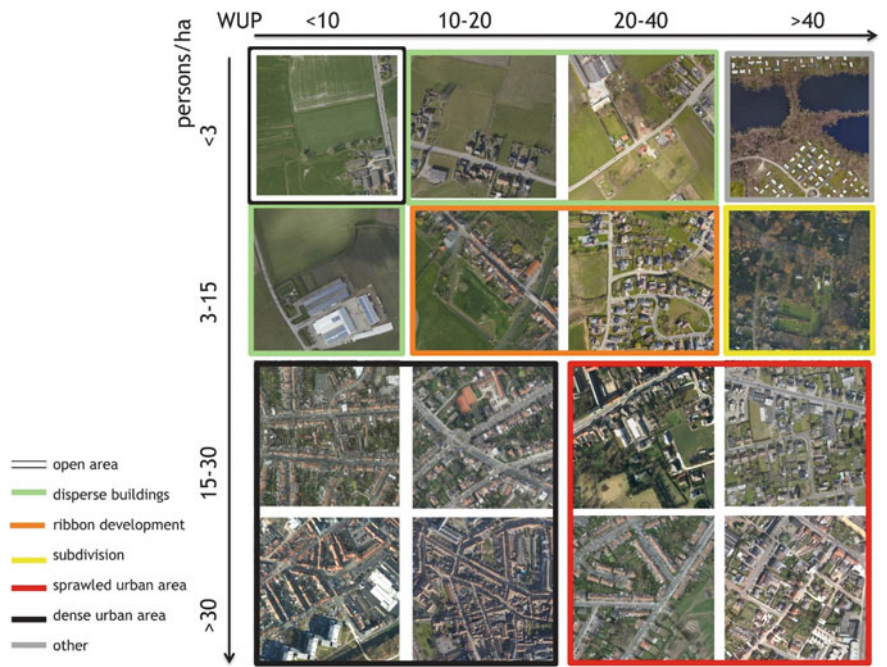


Fig. 3 Urban-sprawl types (Pisman et al. 2018, Fig. 9.10: 413)

Table 3 Key figures of the sprawl typology

	City centers	Villages and peri-urban areas	Allotments and ribbons	Scattered buildings
Covered area (%)	2	10	17	32
Inhabitants (%)	24	43	23	8
Density inhabitants (inh/ha)	59	20	6	1
% Sealed	67	47	30	9
% Land take	96	88	63	27
% Flats	20	10	0	
% Terraced houses	70	40	20	10
% Semi-detached houses	10	20	20	10
% Detached houses	10	30	60	80

4 Conclusions and Discussion

RURA collected and combined a great deal of new data related to the state of the territory in Flanders. Typologically, urbanized, peri-urban, and rural areas were distinguished; cores/ribbons and scattered buildings were mapped; and finally, areas with more or less sprawl were investigated. The three typologies were developed on different scales and resolutions, from different conceptual perspectives and using specific data. An important conclusion, however, is that within any area these three approaches should actually be combined. After all, for example, in a specific peri-urban area, both centers and ribbons may be located, and areas with a sprawl gradient may occur.

The analyses in RURA are currently frequently reproduced in other research reports. Nevertheless, there are still many challenges for the future. In our opinion, we list the three main challenges:

Challenge 1—update analyses and reflect evolutionary changes

RURA was published at the end of 2018 but mainly uses data referring to the status of 2013. In the meantime, we are already seven years further. It is therefore plausible that many things will have changed in the field. Although we know that there is some delay in making source material available, it should be possible already today to provide an update and describe evolution for a number of indicators. In any case, the intention is to launch an updated RURA 2.0 at the end of 2021, three years after the publication of the first Spatial Report.

Challenge 2—develop evidence-based policy

RURA is a status report, and, at present, the policy consequences are limited. At the same time, the Flemish authorities are actively working on a future Spatial Planning Policy Plan. In the documents of this Policy Plan (Departement Ruimte Vlaanderen 2017; Vlaamse Overheid 2012; Vlaamse Regering 2018), the policy objective to limit the land take in Flanders in the future has been made explicit. Implicitly, this also includes the objective of no longer increasing the dispersed built-up area in Flanders, and thus influencing the building typology. In the further operationalization of this policy aim, the insights from the Flanders Spatial Report can be used (more than is currently the case). In addition, the detailed information about the settlement fragmentation in Flanders can help to draw up feasible action lists to realize other objectives, such as switching to renewable energy sources and promoting sustainable commuting.

Challenge 3—revealing the underlying systems

Separate phenomena were often investigated in RURA. However, all phenomena are part of a larger whole or a system of spatial cause-and-effect relationships. A system analysis approach tries to answer the question of how the whole works by focusing on the processes that cause changes. The last chapter of RURA contains a system diagram, which is a strong simplification of reality, but illustrates how the phenomena occur together in space and how Flemish space has evolved over the last 50 years. The system diagram does not fully explain the current situation, but it does allow processes to be described and the possible consequences (desirable or undesirable) of the interaction between the various activities, the available space, policy, and external influences to be mapped out. The authors of RURA intend to focus even more on the coherence of the various phenomena in space in the future. In preparation for RURA 2.0, a scenario exercise and a system analysis of sprawl, among other things, will be elaborated.

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